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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/586,909	01/08/2007	Noritaka Muraki	Q79714	1815

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EXAMINER	
HUBER, ROBERT T	

ART UNIT	PAPER NUMBER
2892	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/586,909	MURAKI ET AL.	
	Examiner	Art Unit	
	ROBERT HUBER	2892	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 May 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2 and 5-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2 and 5-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 May 2008* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The supplemental drawings received on May 13, 2008 are accepted.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 5 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the claim currently depends on canceled claim, therefore it is unclear to which claim that claim 5 currently depends upon.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 2, 5, 11, 16, and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Yamada (US 6,608,330 B1).

a. Regarding claim 1, **Yamada discloses a gallium nitride compound semiconductor light-emitting device** (e.g. figure 1) **comprising**

a crystalline substrate (substrate 101);

a light-emitting of a quantum well structure layer (active layer 106) **which is formed of a gallium nitride compound semiconductor barrier layer doped with an impurity element** (layers 107, disclosed in col. 11, lines 7 – 8 to be formed of GaN, InGaN, AlGaN, or the like. AlGaN may be considered to be doped GaN) **and a gallium nitride compound semiconductor well layer undoped with an impurity element** (layers 108 and 109, disclosed in col. 10, lines 3 – 4 to be undoped), **said light-emitting layer being provided on a second side of the crystalline substrate** (e.g. as seen in figure 1);

a contact layer formed of a Group III-V compound semiconductor for providing an Ohmic electrode for supplying device operation current to the light-emitting layer (layer 111, formed from GaN as stated in col. 8, line 41); **and**

an Ohmic electrode (electrode 112)) **that is provided on the contact layer** (e.g. as seen in figure 1) **and has an aperture through which a portion of the contact layer is exposed** (e.g. as seen in figure 1, the sides of electrode 112 are open, exposing the contact layer 111),

wherein the Ohmic electrode exhibits light permeability with respect to light emitted from the light-emitting layer (col. 10, line 42 discloses the electrode 112 to be transparent), **and the well layer contains a thick portion having a large thickness and a thin portion having a small thickness** (e.g. col. 13, lines 16 - 36, with reference to figure 6, disclose that the well layers have both thin and thick regions).

b. Regarding claim 2, **Yamada discloses a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, wherein the well layer contains a portion having a thickness of 1.5 nm to 0 nm** (col. 13, lines 20 – 22 disclose that, with reference to figure 6, disclose that the well layers have regions with thickness less than half of the average thickness. Col. 9, lines 35 - 36 discloses the average thickness of a well layer to be 3 nm. Therefore, the regions defined by "D" in figure 6 of the well layers are less than 1.5 nm).

c. Regarding claim 5, **Yamada discloses a gallium nitride compound semiconductor light-emitting device, as cited above, wherein the predetermined impurity element added only to the barrier layer is silicon** (e.g. col. 10, lines 3 – 7, disclose that the layer 108 may be doped with Silicon. Col. 9, line 62 discloses the layer 108 may be a barrier layer).

d. Regarding claim 11, **Yamada discloses a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, wherein the Ohmic electrode has a thickness of 1 nm to 100 nm** (col. 10, lines 42 – 43, disclose the electrode has a thickness of 20 nm).

e. Regarding claims 16 and 17, **Yamada discloses a lamp and an LED employing the gallium nitride compound semiconductor light- emitting device according to claim 1** (col. 11, lines 25 – 36).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 6 – 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada in view of Hanaoka et al. (US 5,804,839).

a. Regarding claim 6, **Yamada discloses a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above.**

However, Yamada is silent with respect to the contact layer being doped with an n- type impurity element and has a carrier concentration of 5 x 10^{18} cm^{-3} to 2 x 10^{19} cm^{-3}.

Hanaoka teaches that GaN layers may be formed with n-type impurity concentrations of 1 x 10^{19} cm^{-3} (col. 9, lines 20 - 23).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the contact layer of Yamada to include n-type impurities with a concentration of 1 x 10^{19} cm^{-3} since Hanaoka discloses that this is known structure used for light emitting devices. One would have been motivated to make such a modification since it would allow the layer to exhibit light transmission properties, allowing the light to transmit readily through the layer, and desirable electrical properties for tuning the light emitting device.

b. Regarding claims 7 and 8, **Yamada discloses a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, wherein the contact layer is doped with a p - type impurity element** (col. 8, line 41). **Yamada is silent with respect to the layer having a carrier concentration of 1 x 10^{17} cm^{-3} to 1 x 10^{18} cm^{-3}.**

Hanaoka teaches that p-type contact layers may be doped with a carrier concentration of 1 x 10^{18} cm^{-3} (col. 3, lines 48 – 49).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the contact layer of Yamada to have a p-type

impurity concentration of 1 x 10^{18} cm^{-3} since Hanaoka discloses that this is known contact layer structure used in light emitting devices. One would have been motivated to make such a modification since it would allow the layer to exhibit light transmission properties, allowing the light to transmit readily through the layer, and desirable electrical properties for tuning the light emitting device.

9. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada. **Yamada discloses a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, however Yamada is silent with respect to the contact layer having a thickness of 1 μm to 3 μm.**

Yamada discloses that the contact layer thickness is 0.25 μm.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to enlarge the layer thickness of Yamada, since it has been held by the courts that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device, and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. *In Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984). One would be motivated to make such a modification of the layer thickness in order to make the device structurally more rigid.

10. Claims 12, 13, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada in view of Morita et al. (US 6,121,636). **Yamada discloses a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, however Yamada is silent with respect to a multilayered metallic reflecting mirror made of the same material identical to the Ohmic electrode for reflecting light emitted from the light-emitting layer to the outside, which is provided on a first side of the crystalline substrate.**

Morita discloses a mirror on the outside first side of the crystalline substrate (e.g. figure 1, reflecting layer 11) **wherein the metallic reflecting mirror contains a metallic material identical to that contained in the Ohmic electrode** (e.g. col. 4, lines 1 – 9, discloses that the layer may be made of gold, which is the same material as the electrode 9). Morita further discloses that the layers may be multilayered (col. 2, lines 21 - 25).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the light emitting device of Yamada to include the reflecting mirror, as taught by Morita, since Morita discloses that multilayer reflecting mirrors, made of the same material as the electrode, can be added to light emitting devices. One would be motivated to add a reflecting mirror on the second side of the substrate in order to prevent light escaping from the bottom of the device, thereby protecting underlying structures, as taught in Morita in col. 8, lines 33 - 44. One would be motivated to make the reflecting mirror multilayered to enhance it reflecting ability.

One would further be motivated to make the mirror of the same material as that of the Ohmic electrode since it would require fewer materials for the production process.

11. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada in view of Kaneyama et al. (US 6,452,214 B2). **Yamada discloses a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above, however Yamada is silent with respect to a metallic reflecting mirror containing a single-metal film or an alloy film formed from at least one member selected from the group consisting of silver, platinum, rhodium and aluminum.**

Kaneyama teaches a metallic reflecting mirror formed from aluminum (col. 4, lines 32 - 35).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the light emitting device of Yamada to include the reflecting mirror, as taught by Kaneyama, since Kaneyama discloses that reflecting mirrors made of aluminum can be added to light emitting devices. One would be motivated to add an aluminum reflecting mirror on the second side of the substrate in order to prevent light escaping from the bottom of the device, thereby protecting underlying structures, and aluminum is a readily available material that is can be relatively easily deposited on substrates via known deposition methods (i.e. sputtering, evaporation, etc..)

12. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada in view of Sasaoka (US 2003/0042496 A1).

a. Regarding claim 18, **Yamada discloses a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above. Yamada is silent with respect to the barrier layer being doped with a Group IV element at an average atom density of $1x10^{17}$ cm-3 to $5x10^{18}cm^{-3}$ and which exhibits low resistance.**

Sasaoka discloses a gallium nitride compound semiconductor light-emitting device with barrier layer being doped with a Group IV element at an average atom density of $1x10^{17}$ cm^{-3} to $5x10^{18}cm^{-3}$ which exhibits a low resistance (¶ [0109] discloses the barrier layer to be Si doped with a concentration of $1x10^{18}$ cm^{-3}).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the device of Yamada such that the barrier layers are doped with a Group IV compound with a density of $1x10^{17}$ cm^{-3} to $5x10^{18}cm^{-3}$ since it was known that gallium nitride compound light emitting devices can contain quantum well layers may comprise barrier layers with such dopant and concentrations, as disclosed by Sasaoka. A low resistance is the effect of the doping of the gallium nitride compound with a group VI element at the concentration specified by Sasaoka, so that the modification of the device of Yamada in view of Sasaoka will result in a barrier layer with a low resistance. See MPEP 2112.01. One would have been motivated to make the barrier layer

with a dopant of Group IV materials since these would create an n-type semiconductor barrier layer, allowing one to control the conductivity of the barrier layer, resulting in a more efficient light emission properties of the quantum well.

b. Regarding claim 19, **Yamada discloses a gallium nitride compound semiconductor light-emitting device according to claim 1, as cited above. Yamada is silent with respect to the barrier layer being an Si-doped n-type GaN barrier layer**.

Sasaoka discloses a gallium nitride compound semiconductor light-emitting device with barrier layer being an Si dope n-type GaN barrier layer (¶ [0109] discloses the barrier layer to be Si doped n-type).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the device of Yamada such that the barrier layers are doped with Si to form an n-type barrier layer, since it was known that gallium nitride compound light emitting devices can contain quantum well layers may comprise Si doped n-type barrier layers as disclosed by Sasaoka. One would have been motivated to dope the barrier layer with Silicon to form an n-type layer since the properties of doping silicon in gallium nitride were well-known in the art, and a doping the barrier layer would allow one to control the conductivity of the barrier layer, resulting in a more efficient light emission properties of the quantum well.

Response to Arguments

13. Applicant's arguments filed May 13, 2008 have been fully considered but they are not persuasive. At present, the prior art of Yamada remains commensurate to the scope of claim 1 as stated by the Applicant within the context of the claim language and as broadly interpreted by the Examiner [MPEP 2111], which is elucidated and expounded upon above. In response to Applicants arguments drawn to the amendment, "*a nitride compound semiconductor barrier layer doped with an impurity element*" and "*a gallium nitride compound semiconductor well layer undoped with any impurity element*", Yamada discloses a gallium nitride compound semiconductor barrier layer in col. 9, lines 34 – 40, and further discloses in col. 11, lines 7 - 8 that the barrier layers can be made of GaN, InGaN, AlGaN, or the like. The presence if Aluminum (Al) in the gallium nitride compound (GaN) can be considered to be a dopant of the GaN nitride compound. Yamada discloses a gallium nitride compound semiconductor well layer in col. 9, lines 34 – 40, and further discloses in col. 10, lines 3 – 5 that the well layer "may be undoped". Therefore, Yamada anticipates the claimed limitations.

14. Applicant's arguments with respect to claims 18 and 19 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

15. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT HUBER whose telephone number is (571)270-3899. The examiner can normally be reached on Monday - Thursday (9am - 6pm EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao Le can be reached on (571) 272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lex Malsawma/
Primary Examiner, Art Unit 2892

/Robert Huber/
Examiner, Art Unit 2892
July 3, 2008